PETITION

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Your Petitioners, John Price and Leighton Schafer, citizens of the United States of America and residents of the State of Nebraska, whose residence and mailing address for John Price is 2162 East Lake Drive, Union, Nebraska 68455, and for Leighton Schafer is 310 First Street, Dubois, Nebraska 68345, pray that Letters Patent Protection be granted to them for an

IMPROVED METAL SHEET PUNCH DEVICE

as set forth in the following specification:

Background of the Invention

1. Technical Field

The present invention relates to punch devices and, more particularly, to a metal sheet punch device having a longitudinally extended frame having forward and rearward ends, an alignment device mounted on the frame for aligning the frame on a metal roof, at least two metal punch devices mounted on the frame, each device including a metal punch support arm structure movably mounted on the frame, a generally pointed metal punch mounted on the underside of the metal punch support arm structure, and a support arm structure drive device mounted on the frame which is operatively connected to the metal punch support arm structure to move the metal punch support arm structure between a retracted position and an extended position, and a trigger device operatively connected to each of the metal punch devices to trigger the metal punch devices to punch securement screw indentations in the metal roof.

2. Description of the Prior Art

Metal sheeting for roofs, ceilings and walls are used on many different types of buildings, including both commercial and residential structures. Of these, the metal roof is the most common use of metal sheeting, and the standard metal roof would include a wooden or metal roof frame consisting of a plurality of spaced beams, usually referred to as "nailers" or "purling", extending between and connecting the upper sections of the walls of the building. Mounted on this framework are a plurality of metal roof sections, which generally have widths of between three and four feet (3' to 4' with the usual width being approximately 38") and have lengths of six feet up to forty feet (6' to 40') depending on the intended use of the sheet. The metal sheet sections also are usually "corrugated" to include alternating raised and lowered sections of the roof section for increased structural stability. Once the metal roof section is placed on the underlying roof framework, the metal roof section is affixed to the roof framework by a plurality of screws or other such fasteners which extend downwards through the metal roof section into the framework underneath the metal roof section. The next section of the metal roof is then partially overlapped with the metal roof section affixed to the roof frame, and the process is continued until the metal roof is erected.

While the preceding description of the erection of the metal roof sounds relatively simple, in practice the erection of a metal roof is anything but simple. In fact, two main problems occur with virtually every metal roof erection, the first being that once the metal roof section is placed on the roof frame, the position of

each beam must be estimated beneath the metal roof section to permit proper connection of the metal roof section to the roof frame. Second, the positioning and insertion of each of the fastening screws through the metal roof section should be in an alignment pattern which not only secures the metal roof section to the roof frame, but also is aesthetically pleasing to enhance both the functionality and appearance of the metal roof once it is erected. There is therefore a need for a relatively simple and efficient device which will properly align and space the screws being used to secure the metal roof section to the roof frame.

In the prior art, alignment of the securement screw indentations was generally performed by formation of a chalk line on the metal roof section. Specifically, a roof installer would extend a chalk line from one end of the metal roof section being installed to the opposite end thereof with the chalk line aligned above the metal roof section with the roof support beam positioned underneath the metal roof section such that when the chalk line was "snapped," the resulting chalk line would be aligned generally parallel with the underlying roof beam. The roof installer would then proceed along the chalk line marking at generally equal distances the locations for the series of securement screw indentations to be formed in the metal roof section. Once the locations of the securement screw indentations were determined along the chalk line, the roof installer would then proceed to form the indentations with a metal punch and hammer, forming each of the indentations one at a time along the chalk line, or alternatively may even use only a self-tapping screw to pierce the metal sheet. Finally, the roof installer would return to each of the securement

screw indentations and insert the securement screw into the indentation to secure the metal roof section to the underlying roof support beam. Although years of practice may increase the speed with which the above-described method is performed, it is abundantly clear that this procedure is time-consuming and fraught with opportunities for error and therefore there is a need for an improved system and device by which a plurality of securement screw indentations may be formed in the metal roof section in an accurate and efficient manner.

There are some devices found in the prior art which, when used in connection with some types of formed sheet metal such as gutters and the like, will form a punch hole in the metal. These single-punch devices have been in existence and have been used with metal gutters, but the modifications necessary to permit use of these devices with metal sheets often would render the devices inoperable for their original intended purpose. Furthermore, although these devices, if modified, could conceivably provide alignment for a single screw to be placed through a metal roof section into the underlying frame, they still will not solve the problem of the alignment of multiple screws and the spacing thereof to enhance the functionality and appearance of the series of screws. There is therefore a need for a multiple punch device which will not only provide alignment of the screw holes with the underlying roof frame, but will also space the screws in their preferred securement spacing to ensure both improved functionality and improved aesthetic appearance.

There is therefore a need for an improved metal sheet punch device.

Another object of the present invention is to provide a metal sheet punch device which includes a longitudinally extended frame having alignment devices mounted thereon to properly align the metal frame on the metal roof and at least two metal punch devices mounted on the frame for forming at least two indentations in the metal roof into which fastening screws may be quickly and easily inserted.

Another object of the present invention is to provide a metal sheet punch device in which the metal punch devices include a metal punch support arm structure movably mounted on the frame, a generally pointed metal punch having a pointed lower end mounted on the underside of the metal punch support arm structure, and a support arm structure drive device such as a spring or pneumatic jack which is operatively connected to the metal punch support arm structure to move the metal punch support arm structure between a retracted position and an extended position to drive the metal punch into the metal roof section.

Another object of the present invention is to provide a metal sheet punch device which will quickly and easily form multiple securement screw indentations in a metal roof section, the indentations being properly spaced from one another and generally accurately aligned with the underlying roof beam to which the metal roof section is to be affixed.

Another object of the present invention is to provide a metal sheet punch device which can be quickly and easily used to form the securement screw indentations, yet which does not necessarily require connection to an external power source, thus preventing wire entanglements and the necessity for hose connections required

by other devices found in the prior art.

Finally, an object of the present invention is to provide a metal sheet punch device which is relatively simple and economical in construction and is safe, efficient, and accurate in use.

Summary of the Invention

The present invention provides a metal sheet punch device for metal roofs which includes a longitudinally extended frame having forward and rearward ends and alignment devices mounted on the frame adjacent the forward and rearward ends for aligning the frame on a metal roof. At least two metal punch devices are mounted on the frame, each of the metal punch devices including a metal punch support arm structure movably mounted on the frame, the metal punch support arm structure movable between a retracted position and an extended position relative to the frame, and a generally pointed metal punch having a pointed lower end, the generally conical metal punch mounted on the underside of the metal punch support arm structure. A support arm structure drive device such as a coiled spring or pneumatic jack is mounted on the frame and operatively connected to the metal punch support arm structure to rapidly move the metal punch support arm structure between the retracted position and the extended position. Finally, a trigger device is operatively connected to the metal punch devices, the trigger device operative to trigger each of the support arm structure drive devices operatively connected to each of the metal punch devices to drive the metal punch support arm structures from the retracted position to the extended position such that the metal punches engage the metal roof positioned there underneath to generally simultaneously form at least two spaced-apart indentations in the metal roof by impact of the metal punches with the metal roof, the indentations then being used for the insertion and alignment of securement screws to secure the metal roof section on the underlying roof support frame.

The metal sheet punch device as thus described is far superior to those devices found in the prior art. Specifically, the ability of the present device to perform simultaneous multiple punches which are accurately aligned with the underlying roof frame greatly decreases the amount of time needed to align and lay out the punched indentations required when using the methods of the prior art, such as chalk lining or the like. Furthermore, because the present invention, when outfitted with coiled springs, is independent of any power source, it is much easier and safer for a roof installer to use than many other electrical or pneumatic devices used in construction. Also, because of the forward and rearward alignment devices mounted on the longitudinally extended frame, it is difficult for a user of the present invention to incorrectly use and align the invention, thus greatly reducing the opportunity for mistakes and increasing the efficiency with which the metal roof is assembled. Finally, because the metal sheet punch device of the present invention is generally intuitive in use, it does not take a great deal of training to learn to use the present invention, meaning that virtually any worker from the most skilled to the least skilled may use the present invention to properly and quickly produce securement screw indentations in the metal roof sections. It is thus seen that the present invention provides a substantial improvement over those roof punch devices found in the prior art.

Brief Description of the Drawings

Figure **1** is a perspective view of the metal sheet punch device of the present invention being used on a metal roof;

Figure **2** is a perspective view of the metal sheet punch device of the present invention;

Figure **3** is a detailed side elevational view of the present invention during the "cocking" phase of use;

Figure **4** is a detailed side elevational view of the present invention immediately prior to triggering of the metal punches;

Figure **5** is a detailed exploded perspective view of one metal punch device found in the present invention;

Figure **6** is a detailed side elevational view of one metal punch device of the present invention showing the operation of the punch device;

Figure **7** is a detailed side elevational view of one metal punch device of the present invention showing the metal punch forming an indentation in the metal roof section; and

Figure **8** is a detailed side elevational view of the rearward end of the longitudinally extended frame showing the trigger bar being raised to trigger the operation of the metal punch devices.

Description of the Preferred Embodiment

The metal sheet punch device **10** of the present invention is shown best in Figures **1-4** as including a longitudinally extended frame **12** having a forward end **14** and rearward end **16** and a plurality of metal punch devices **50a**, **50b**, **50c**, and **50d** which are movably mounted on the frame **12**. In the preferred embodiment, the longitudinally extended frame **12** is constructed as including a pair of generally parallel frame plates **18a** and **18b** which are constructed of a durable material such as metal, aluminum or hardened plastic and would have a length of approximately 36 to 60 inches, a vertical height of approximately 1 to 6 inches, and would be spaced from one another approximately 1 to 6 inches, the frame plates **18a** and **18b** being supported apart from and connected to one another by a plurality of spacer rods **20**. It is further preferred that each of the elements of the present invention be constructed of rigid and durable materials, and therefore it is expected that the metal sheet punch device **10** will be constructed of metal such as steel or aluminum or a hardened plastic material, depending on the intended functionality of the element being constructed.

Mounted on and extending forwards from forward end **14** of frame **12** is forward alignment device **22** which, in the preferred embodiment, would include a pair of mounting arms **24a** and **24b** extending forwards from the frame **12** and an alignment plate mounting bar **26** which extends between and connects the forward ends of mounting arms **24a** and **24b**, as shown best in Figure **2**. Mounting on and extending forwards from alignment plate mounting bar **26** is the alignment plate **28** which, in the preferred embodiment, would be a generally rectangular or trapezoidal plate extending generally

horizontally from the alignment plate mounting board **28** and would further include a generally U-shaped screw engagement slot **30** formed in the forward end of alignment plate **28** and extending rearwards towards frame **12** as shown best in Figure **2**. The screw engagement slot **30** is designed to fit over and engage a securement screw **92** which has already been mounted on the metal roof section **90** as shown best in Figure **1**. As this securement screw **92** is already accurately aligned on the metal roof section **90** extending into the underlying roof frame beam **94**, engagement of the securement screw **92** by the screw engagement slot **30** results in a precise proper alignment of the forward end **14** of longitudinally extended frame **12** on the metal roof section **90**.

Mounted on rearward end **16** of longitudinally extended frame **12** is a rearward alignment structure **32** which, in the preferred embodiment, includes a pair of downwardly depending rear alignment bars **34a** and **34b** mounted on the outside of each of the frame plates **18a** and **18b** and extending downward below the base of the frame plates **18a** and **18b** approximately one to four inches. Due to the overall length of longitudinal frame **12**, when the metal sheet punch device **10** is placed on the metal roof section **90** with the screw engagement slot **30** engaging securement screw **92**, the rear alignment bars **34a** and **34b** are positioned outside of the edge of metal roof section **90** to depend downwards over the roof frame beam **94** on which the metal roof section **90** is to be mounted. Each of the rear alignment bars **34a** and **34b** are positioned on the opposite side of the roof frame beam **94** thus ensuring that the metal sheet punch device **10** is properly aligned on the metal roof section **90** such that the securement screw indentations formed by the metal sheet

punch device **10** are aligned with the roof frame beam **94** on which the metal roof section **90** is positioned. The positioning of the metal sheet punch device **10** is thus correctly performed by merely aligning the forward alignment structure **22** with the securement screw **92** and the rearward alignment structure **32** with the roof frame beam **94**, an operation which can be performed quickly and easily with a maximum degree of accuracy each and every time the metal sheet punch device **10** of the present invention is used.

The metal sheet punch device **10** of the present invention also may include forward and rearward frame support legs **36a**, **36b**, **38a** and **38b** mounted on and extending downwards from frame **12** which assist with the positioning and support of the frame **12** when placed on the metal roof section **90**. The metal sheet punch device **10** of the present invention also may include a forward handle **40** and a carrying strap (not shown) to facilitate the lifting and placing of the metal sheet punch device **10** on the metal roof section **90**.

While the positioning of the metal sheet punch device **10** of the present invention in the proper orientation is important, it would be of little effect if the formation of the securement screw indentations still need to be performed by hand. Therefore, the metal sheet punch device **10** of the present invention includes a plurality of metal punch devices **50a-d** each of which are designed to mechanically create a securement screw indentation in the same manner each and every time to ensure accurate spacing and accurate placement of the securement screw indentations. As each of the metal punch devices **50a-d** are generally identical to one another and are triggered in substantially the same manner, the following description of metal punch device **50a** should be understood to apply

equally to metal punch devices **50b**, **50c** and **50d**.

Metal punch device **50a** is shown best in Figures **5**, **6** and **7** as including a metal punch support arm structure **52** which includes left and right punch support bars **54a** and **54b**, actuating arm **56** mounted on and extending forwards from punch support bars **54a** and **54b** and the metal punch **58** itself which is mounted on the punch support bars **54a** and **54b** and extends downwards therefrom. The punch support bars **54a** and **54b**, actuating arm **56** and metal punch **58** are secured to one another by a plurality of bolts **60** and the assembled metal punch support arm structure **52** is pivotally mounted on the longitudinally extended frame **12** via pivot bolt **62** which extends through the rearward ends of punch support bars **54a** and **54b** and through the frame plates **18a** and **18b**.

Mounted on and extending between the frame plates **18a** and **18b** rearward of the metal punch support arm structure **52** is a spring anchor **64** which would preferably consist of a plate **66** having a bolt **68** extending therethrough to secure the back end of the coiled spring **70** such that when metal punch support arm structure **52** is pivoted about pivot bolt **62**, the tension in coiled spring **70** attempts to drive the metal punch support arm structure **52** downwards, or as is shown in Figure **7**, rotate the metal punch support arm structure **52** in a counterclockwise direction about pivot bolt **62** thus driving metal punch **58** downwards to contact the metal roof section **90** over which the metal sheet punch device **10** is positioned. Of course, it should be noted that the coiled spring **70** may be replaced by any appropriate drive device, such as a pneumatic or hydraulic piston or ram which would be connected to the metal punch support arm structure **52** in the appropriate manner

to drive the metal punch support arm structure **52** downwards to drive metal punch **58** into the metal roof section **90** to create the securement screw indentation **96** shown best in Figure **7**. Such substitution of alternate drive devices would be understood by those skilled in the art of pneumatic and hydraulic systems.

The trigger mechanism for the metal punch support arm structure **52** is shown best in Figures **5**, **6** and **7** as including a pair of downwardly and forwardly depending trigger bars **74a** and **74b** between which extends an actuating arm engagement bolt **76** which extends through the generally L-shaped slot **57** in actuating arm **56** as shown best in Figures **6** and **7**. The upper ends of trigger bars **74a** and **74b** are connected to trigger actuating arm **78** which extends along the length of frame plates **18a** and **18b** as shown best in Figure **6**. The trigger actuating arm **78** is slidably mounted between frame plates **18a** and **18b** such that the trigger actuating arm **78** may be slid in a generally horizontal plane. The sliding or "cocking" of the trigger actuating arm **78** is performed by the rotation of trigger bar **80** which is rotatably mounted on the frame **12** as shown best in Figures **3** and **4**. The metal punch device **50a** would thus be triggered in the following manner.

As trigger bar **80** is rotated upwards, trigger actuating arm **78** is slid rearwards towards the rearward end **16** of longitudinally extended frame **12** thus producing the movement shown best in Figures **6** and **8** of the drawings. The movement of the trigger actuating arm **78** moves trigger bars **74a** and **74b** rearwards permitting actuating arm bolt **76** housed within L-shaped slot **57** of actuating arm **56** to slide rearwards and fall into the lower section of the L-shaped slot **57** as shown in Figure **6**. As trigger bar **80** is returned to its

position adjacent the frame **12**, trigger actuating arm **78** is slid forwards and, as best shown in Figure **7**, the trigger bars **74a** and **74b** are slid forward also with actuating arm bolt **76** being temporarily caught within the lowermost portion of L-shaped slot **57** of actuating arm **56**. This causes the metal punch support arm structure **52** to be pulled upwards and forwards in clockwise rotation about pivot bolt **62** (from the viewpoint of Figure **7**) thus tensioning coiled spring **70**. As the sliding of trigger actuating arm **78** continues, the actuating arm bolt **76** eventually reaches a point within L-shaped slot **57** of actuating arm **56** where it no longer is frictionally retained within the lowermost portion of L-shaped slot **57** and the actuating bolt **76** slides forwards within L-shaped slot **57** releasing actuating arm **56** and thus metal punch support arm structure **52**. The tension built up in coiled spring **70** thus is released driving the metal punch **58** downwards to impact the metal roof section **90** to create the securement screw indentation **96** as shown best in Figure **7**. As each of the metal punch devices **50a-d** are generally identical and are generally identically connected to the trigger actuating arm **78** and trigger bar **80**, each of the metal punch devices **50a-d** are generally simultaneously triggered to create four identical securement screw indentations **96** which are spaced along the metal roof section **90** in the predetermined indentation locations. The metal sheet punch device **10** may then be moved to the next location, aligned and triggered to create the next set of securement screw indentations in the metal roof section **90**. It is thus seen how quickly and easily a number of indentations is formed in the metal roof by use of the present invention, thus greatly increasing the efficiency of the user of

the present invention and reducing mistakes and risks associated with those devices and systems found in the prior art for performing the indentation forming task.

For facilitating carrying of the metal sheet punch device **10** of the present invention, a carrying strap **82** may be attached to one or more of the spacer rods **20** as shown in Figures **1** and **2**. The carrying strap **82** is preferably constructed of nylon or another such durable material and is used in conjunction with the trigger bar **80** to lift and carry the metal sheet punch device **10** between use locations.

It is to be understood that numerous modifications, additions and substitutions may be made to the present invention which fall within the intended broad scope of the appended claims. For example, the size, shape and construction materials used in connection with the metal sheet punch device **10** of the present invention may be modified or changed so long as the intended functionality of the invention is maintained. Likewise, the precise nature of the support arm structure drive device may be modified or changed to incorporate not only a coiled spring but other types of drive devices such as pneumatic or hydraulic pistons, any of which would be understood by those skilled in the art of such systems. Furthermore, the precise nature of the triggering device and precise arrangement of the metal punch devices may be modified or changed so long as the intended functional features of creating a plurality of securement screw indentations in a metal roof section in a general simultaneous manner is preformed. Finally, although the present invention has been described for use in connection with corrugated metal roofs,

it may be adapted for use in virtually any situation where a plurality of spaced indentations are to be formed to permit the insertion of fastening devices therein.

There has therefore been shown and described a metal sheet punch device **10** which accomplishes at least all of its intended objectives.